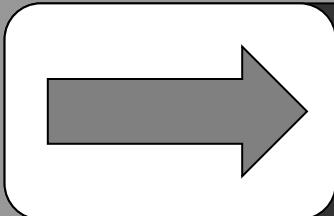


Wed Sept 24<sup>th</sup> 2014.

CIVL 498C Life Cycle Assessment

## Week 4: LCA in the Construction Industry



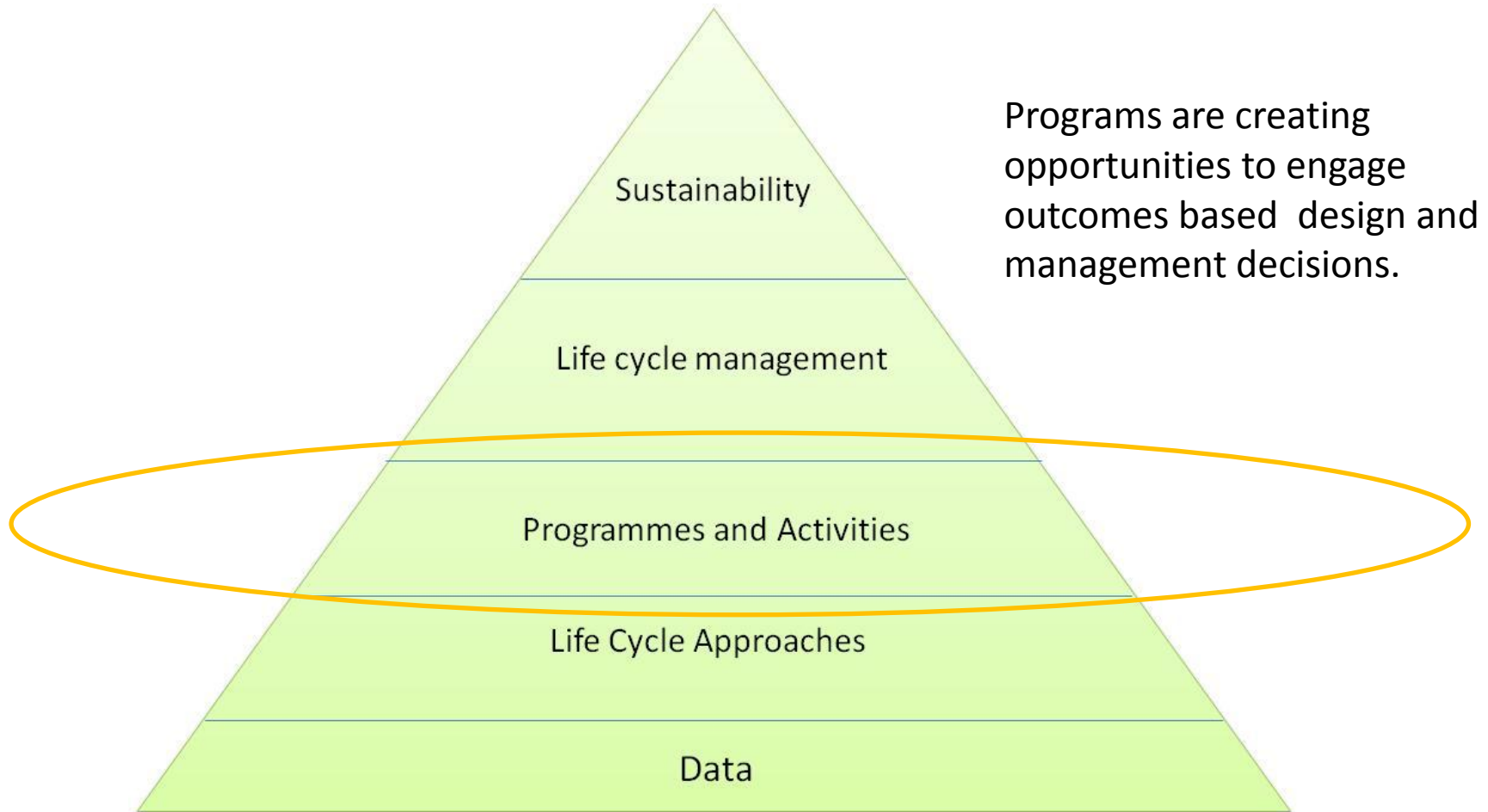
slide to unlock

# Presentation Outline

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- 1. LCA opportunities in Construction Industry**
2. Tools
3. Applying LCA on projects

## UNEP/SETAC Sustainability Framework



# LCA studies → PCRs and EPDs



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## Environmental Product Declarations Program

- [About the Program](#)
- [Why ASTM International](#)
- [Product Category Rule](#)
- [EPD Development Process](#)
- [News](#)
- [Frequently Asked Questions](#)
- [Contact Us](#)

### About the Program


With the proliferation of green measurement systems and labels, there is a growing need to understand the true impact of a product on the environment. Environmental product declarations (EPDs) provide quantifiable environmental data to compare products that fulfill the same function. In order to create comparable EPDs, they must follow the same rules and guidelines called product category rules (PCRs).

PCRs, similar to standards, are best developed in a collaborative manner and ASTM is uniquely positioned to provide the venue for developing industry PCRs.

As a Program Operator, ASTM International has developed its program in conformance with ISO 14025 - Environmental Labels and Declarations - Type III Environmental Declarations - Principles and Procedures.

### Why ASTM International

# LCA studies → PCRs and EPDs

MyHome Lo

[Company](#)[Businesses](#)[Services](#)[Standards](#)

## Environment

---

### Services

- Certification
  - Sustainable Product Certification
  - Indoor Air Quality Certification
  - Corporate Sustainability Programs
  - Environmental Product Declarations**
    - » Product Category Rules
    - » EPD Development Process
- Validation
- Testing
- Consulting

---

- Sustainable Product Database
- Newsroom
- Resources
- About UL Environment
- Contact Us

Home > Businesses > Environment > Services > Certification > **Environmental Product Declarations**

## Environmental Product Declarations (EPDs)

### Deliver transparency into a product's environmental impacts, from cradle-to-grave.

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Now, more than ever before, buyers are demanding to know the full extent of a product's environmental and health impacts. From raw material extraction, production, and packaging to distribution, end-use, and disposal, transparency into the impacts of a product at each stage of its lifecycle has become a critical driver of purchases and specifications.

Manufacturers that voluntarily disclose all of their products' cradle-to-grave impacts are seen as trailblazers in the sustainability marketplace. Environmental Product Declarations (EPDs) enable manufacturers to make those disclosures in a credible, streamlined, and universally understood manner. Thus, EPDs demonstrate a manufacturer's commitment to sustainability and showcases that manufacturer's willingness to go above and beyond—all in the name of transparency and clarity.

### What is an EPD?

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# LCA studies → PCR and EPDs



Setting the standard for sustainability.™

Services ▾

Certified Clients and Products ▾

About SCS ▾

Responsible Forestry +

Climate +

Sustainable Seafood +

Environmental Claims

BIFMA level®

FloorScore®

Green Squared®

Indoor Air Quality

Green Product Certification

Environmental Product Declaration

Environmental Claims Validation

Environmentally Preferable Product

Life Cycle Assessment (LCA)

Safeway Bright Green

Home Depot Eco Options

Sustainability Services +



## Environmental Product Declaration Full Transparency of Life Cycle Impacts

The Environmental Product Declaration (EPD) is an internationally recognized summary report used to transparently communicate the environmental performance of your products and services based on life cycle assessment (LCA). EPDs distill complicated information to empower your customers, architects and designers, procurement agents and consumers to make informed decisions.

SCS Global Services is a leading LCA practitioner and third-party certifier of environmental claims. We developed the world's first EPDs, and understand the importance of getting the science right while remaining cost-effective. Choose from existing Product Category Rules (PCRs) or take advantage of the most advanced LCA science to obtain

# LCA studies → PCRs and EPDs



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Public

[Home](#) > [Standards](#) > [Environment & Carbon Management](#) > [Environmental Product Labeling & Declaration](#)

## Environmental Product Labeling & Declaration

### Overview

### Environmental Product Labeling & Declaration

Most organizations have developed an understanding of the importance of reducing their environmental impact. Carbon management programs are becoming commonplace, and progressive organizations are pursuing net carbon neutrality in their day-to-day operations.

But what about the environmental impact of the products they sell? In order to make more informed buying decisions, customers are driving organizations to become more transparent as to the environmental legacy their product offerings leave throughout their lifecycle.

One method that is gaining acceptance in North America and around the world is the use of "Environmental Product Declarations" (or EPDs). A key component of a fully-transparent EPD is the creation of an appropriate set of "Product Category Rules" (or PCRs).

As a recognized leader in global environmental standards development, with a proven reputation in product certification and testing services, CSA Group brings considerable credibility to its newly-announced role as a Program Operator for the development of PCRs. Harnessing our renowned consensus-based standards development process, CSA Group can bring disparate industry groups together for the purpose of creating a common set of procedures for evaluating the environmental impact of products. The end goal of the PCR development process is a set of criteria, endorsed by stakeholders, that enables fair comparisons of the environmental impact of similar products, helping facilitate informed product decisions.

# Opportunities in Construction

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## Recognized codes and standards.

- LEED v.4
- Green Globes
- IgCC
- CalGreen



## Guidance

- ISO 21931-1
- EN 15978
- Athena Guidelines



<http://www.coldstreamconsulting.com/life-cycle-analysis>



# Opportunities in Construction

---

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- IgCC
- CalGreen



## Guidance

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<http://www.coldstreamconsulting.com/life-cycle-analysis>

# Presentation Outline

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1. LCA opportunities in Construction Industry
- 2. Tools**
3. Applying LCA on projects

- 
- Building design LCA tools
    - Impact Estimator
    - BEES
    - Tally
  - LCA practitioner tools
    - SimaPro
    - GaBi

- 
- Impact Estimator for Buildings (IE4B)
    - by Athena Sustainable Materials Institute
    - Uses Athena LCI Database and US LCI Database
    - Requires detailed knowledge for Inputs
      - Building Information
      - Operating Energy
      - Assemblies (ie. elements)
      - Material Information

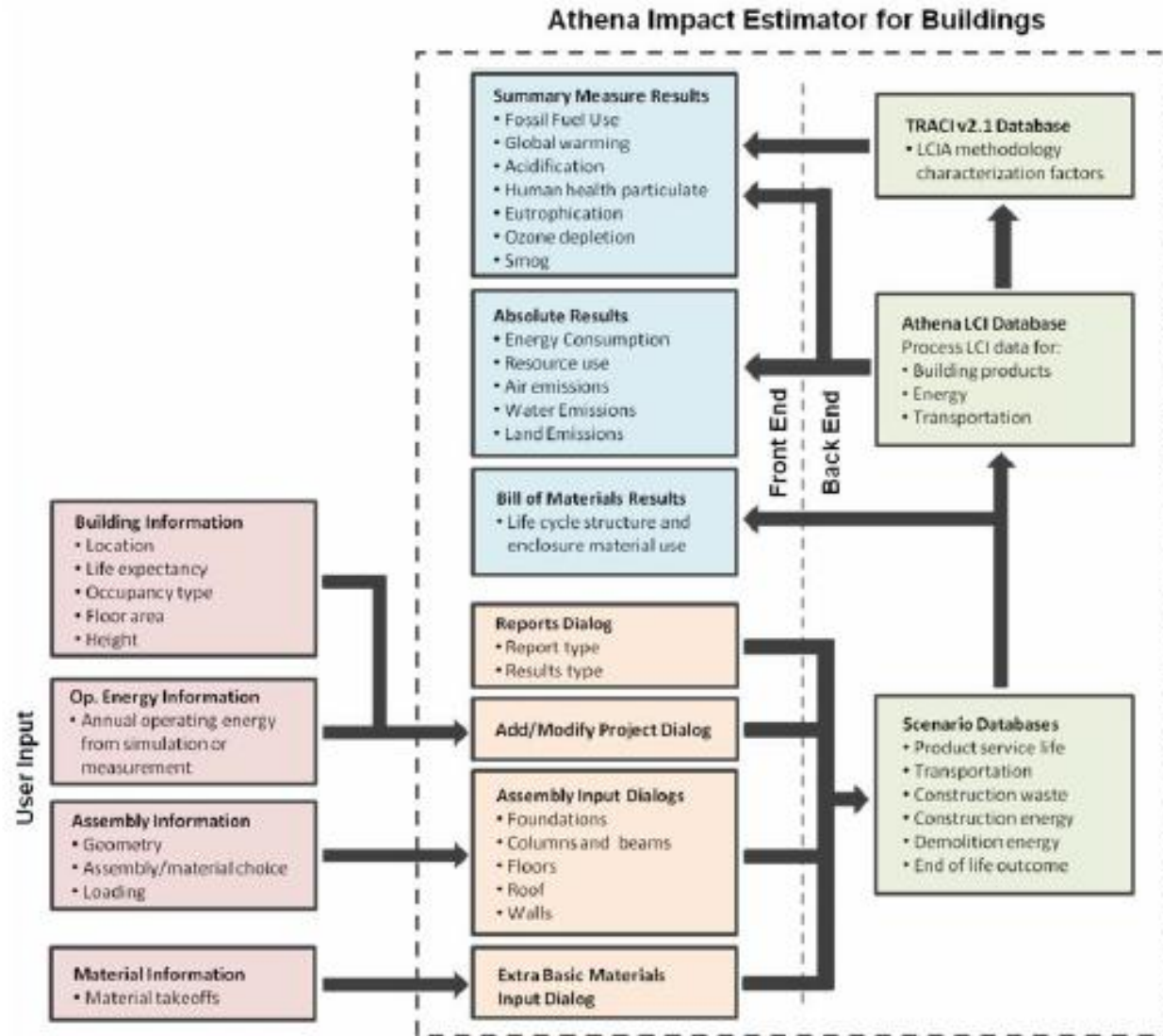
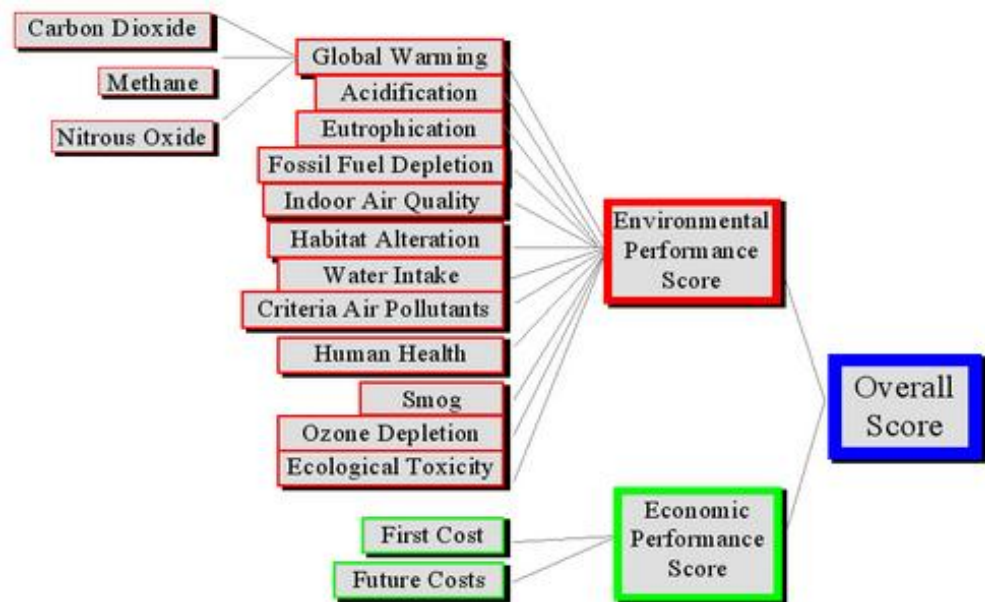


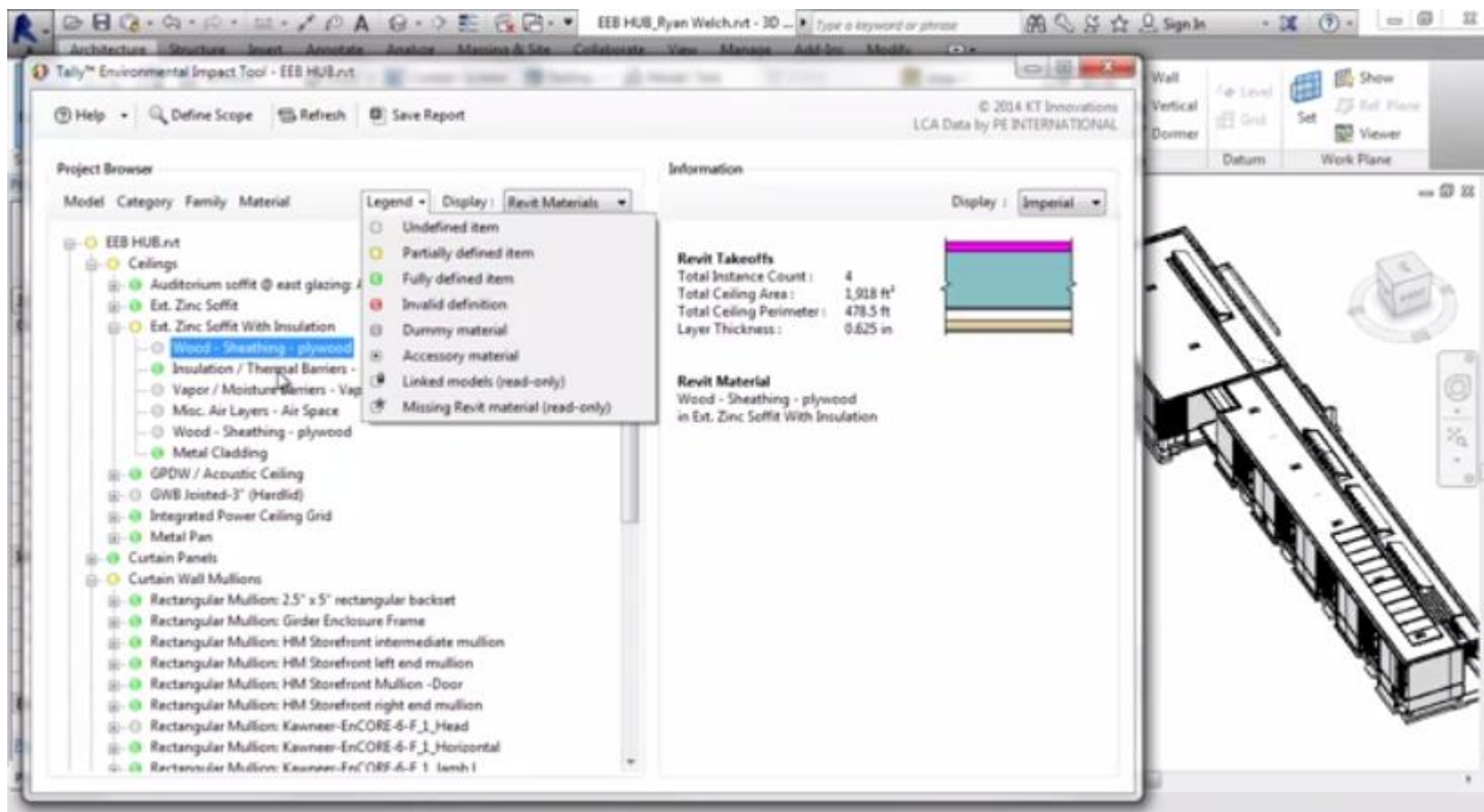
Figure 1: How the Impact Estimator for Buildings Works

- Building for Environmental and Economic Sustainability (BEES)
  - by National Institute of Standards and Technology
  - Uses ASTM multi-attribute decision analysis



- 
- Tally
    - By KT Innovations
    - Uses GaBi database, by PE International
    - Integrated with Revit software (Building Information Modeling (BIM))

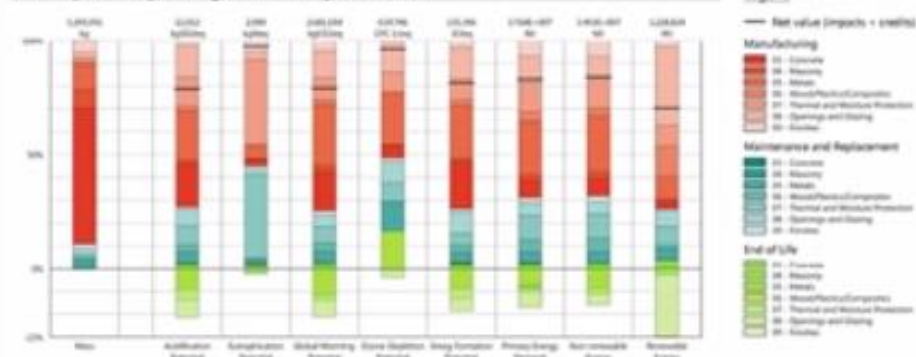
- Tally



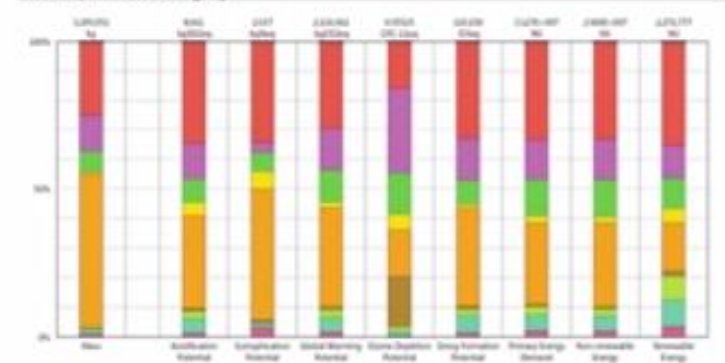


- Tally

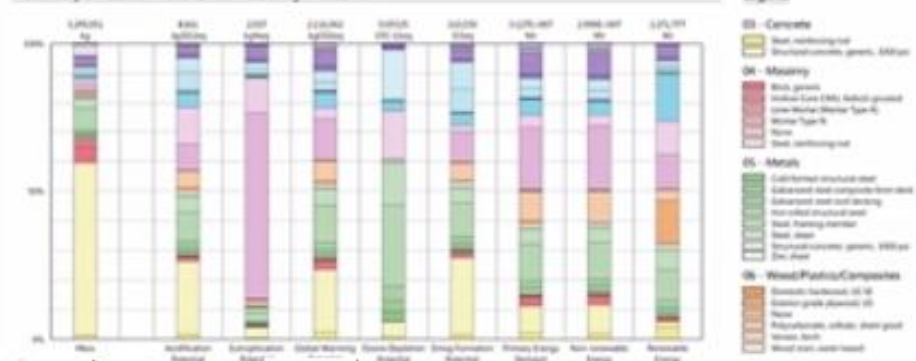
Results per Life Cycle Stage, itemized by CSI Division



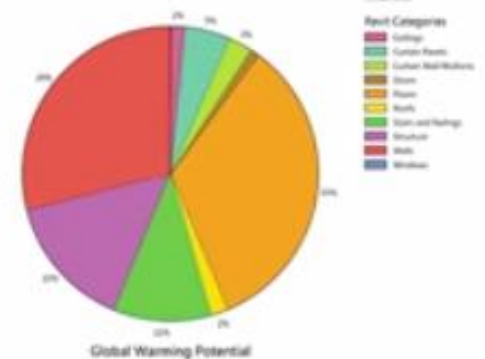
### Results per Revit Category



Results per CSI Division, Itemized by Material

[illegible]

Legend



- 
- Building design LCA tools
    - Impact Estimator - <http://calculatelca.com/>
    - BEES - <http://www.nist.gov/el/economics/BEESSoftware.cfm>
    - Tally - <http://www.choosetally.com/>
  - LCA practitioner tools
    - SimaPro - <http://www.pre-sustainability.com/simapro>
    - GaBi - <http://www.gabi-software.com/canada/index/>

# Presentation Outline

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1. LCA opportunities in Construction Industry
2. Tools
- 3. Applying LCA on projects**

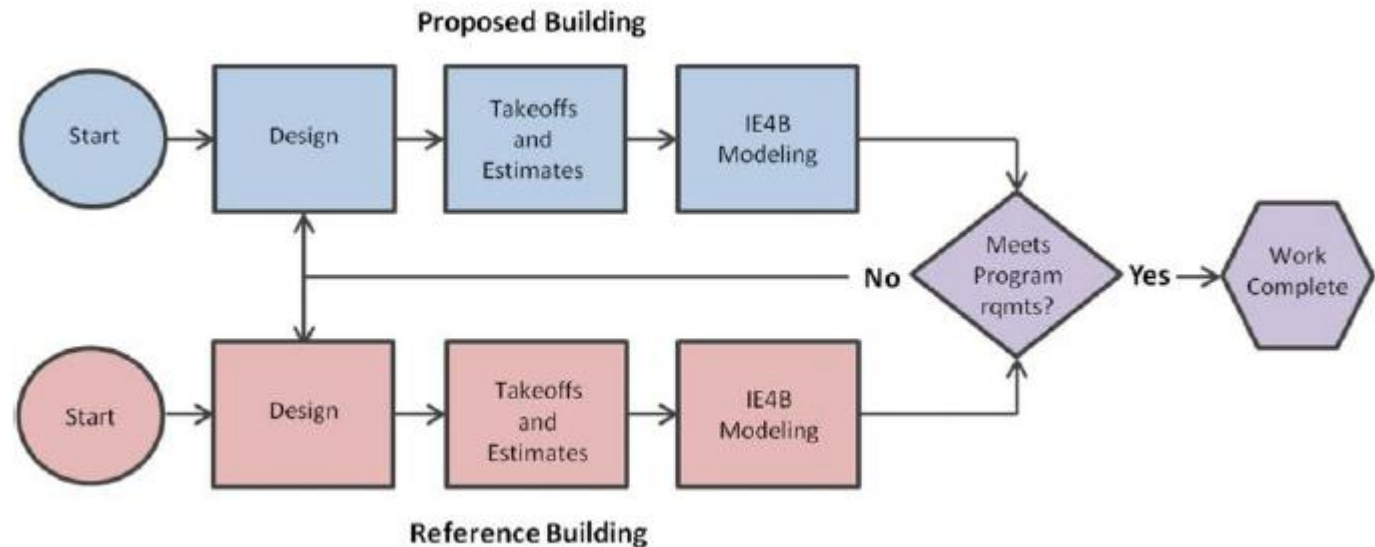
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- Applying LCA on Projects

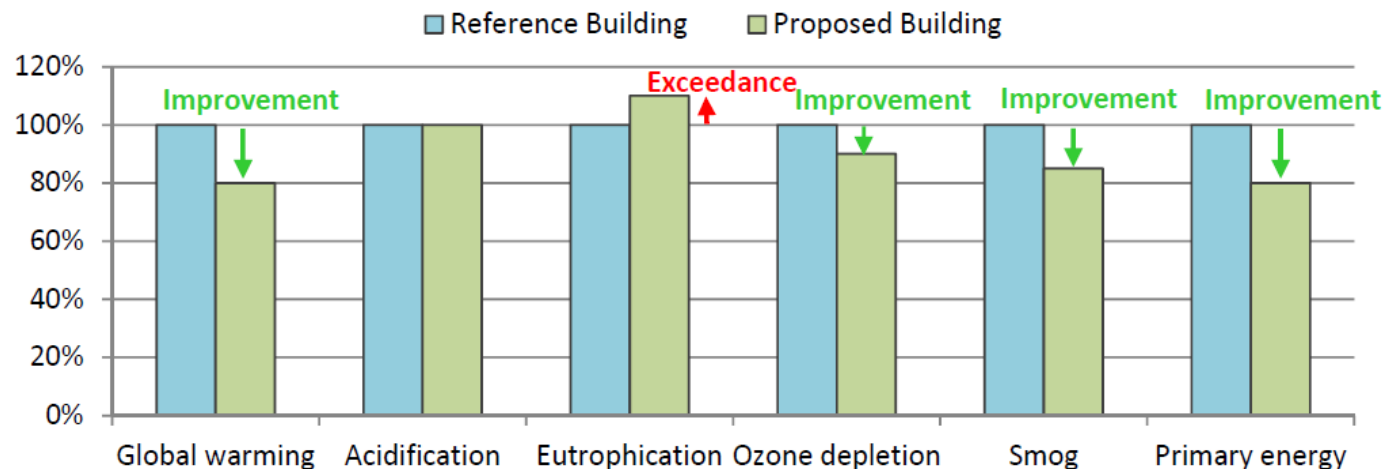
1. Building design
2. Integrated analysis
3. Building declaration

# Applying LCA on Projects

## Comparative LCA Process



## Comparative Concept in Green Building Programs



# Applying LCA on Projects

## 1. Building design

- Develop designs for proposed and reference buildings.
- Option similarities
  - Size
  - Function
  - Orientation
  - Energy performance
  - Service life

Table 1: DEC Objects of Assessment Summary

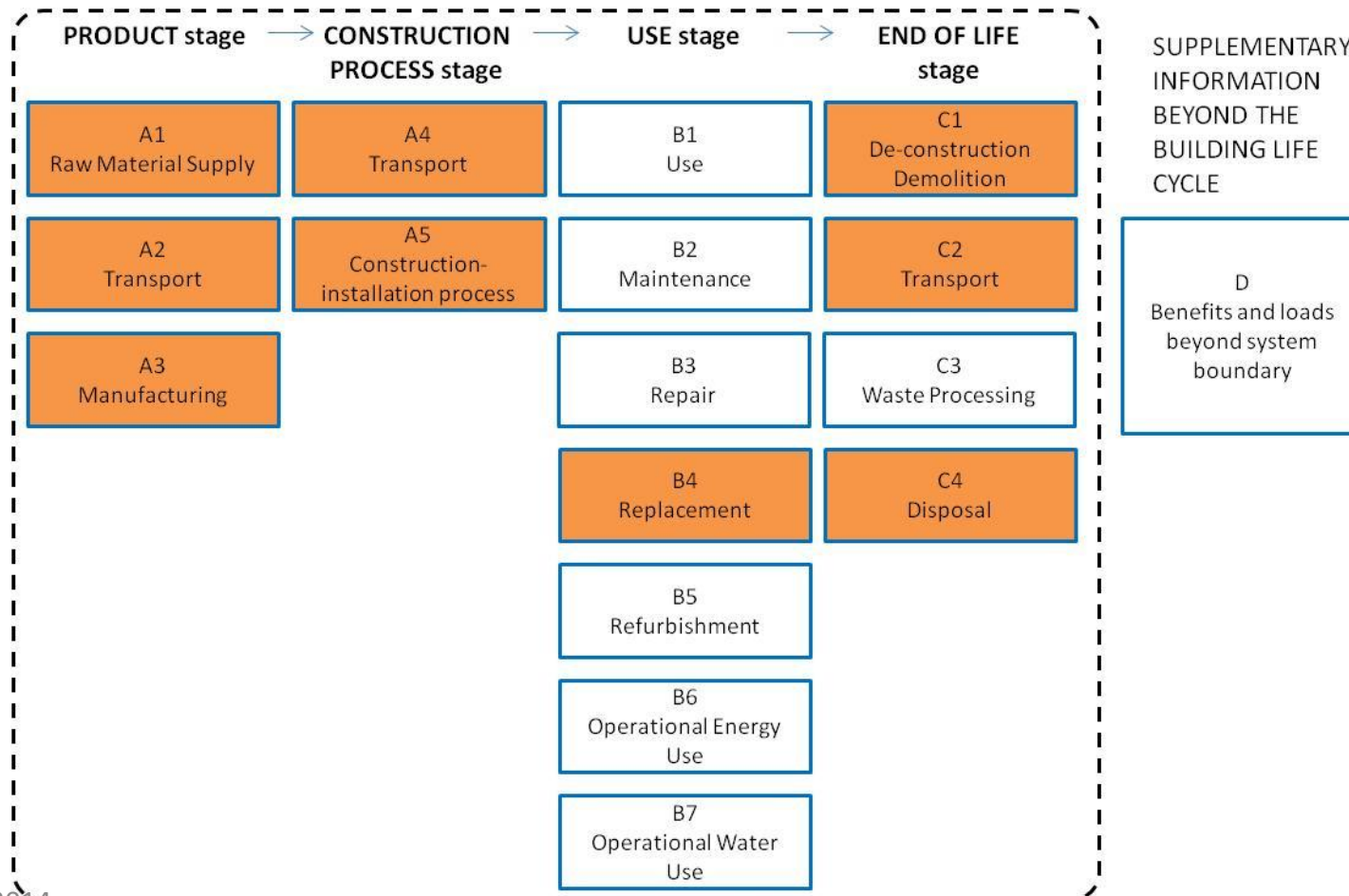
Building Element	OPTION 1: Hybrid Design	OPTION 2: Steel Design
A11 Foundations	Perimeter and interior walls supported by cast-in-place foundation wall and strip footings; perimeter and interior columns supported by piers and pad footings	
A21 Lowest Floor Construction	150mm and 100mm cast-in-place slab on grade on aggregate sub base	
A22 Upper Floor Construction	Second Floor: 239mm CLT floor with 50mm concrete topping and 210mm Comfloor composite floor slab supported glulam beams and steel columns	Second Floor: 210mm Comfloor composite floor slab supported by steel beams and columns
	Mezzanine: Metal grate supported by steel beams and columns	
A23 Roof Construction	External walls: 200mm cast-in-place concrete and 239mm CLT walls	External walls: Steel studs infill with exterior sheathing and interior GWB, and 200mm CMU walls
	Lower roof: 239mm CLT and 210mm Comfloor composite deck supported by glulam and steel beams, and steel columns	Lower roof: 210mm Comfloor composite deck supported by steel beams and columns
	Upper roof: 239mm CLT deck supported by glulam and steel beams and columns	Lower roof: 210mm Comfloor deck supported by steel beams and columns
A32 Walls Above Grade	Aluminum framed glazed curtain wall, and aluminum composite panel and perforated metal panel projections c/w steel supports	
B11 Partitions	Non-structural: Gypsum board on both sides of metal studs c/w sounds attenuation batts, and metal framed glazed screens	
	Structural: 99mm and 239mm CLT, and 200mm cast-in-place concrete walls	Structural: 200mm CMU walls

Table 1 shows that differences between the two design options analyzed are found within the Upper Floor and Roof Construction, and Partitions elements (A22, A23, and B11), with the remaining elements the same across cases.

# Applying LCA on Projects

## 1. Building design

- Develop LCA models of proposed and reference buildings.



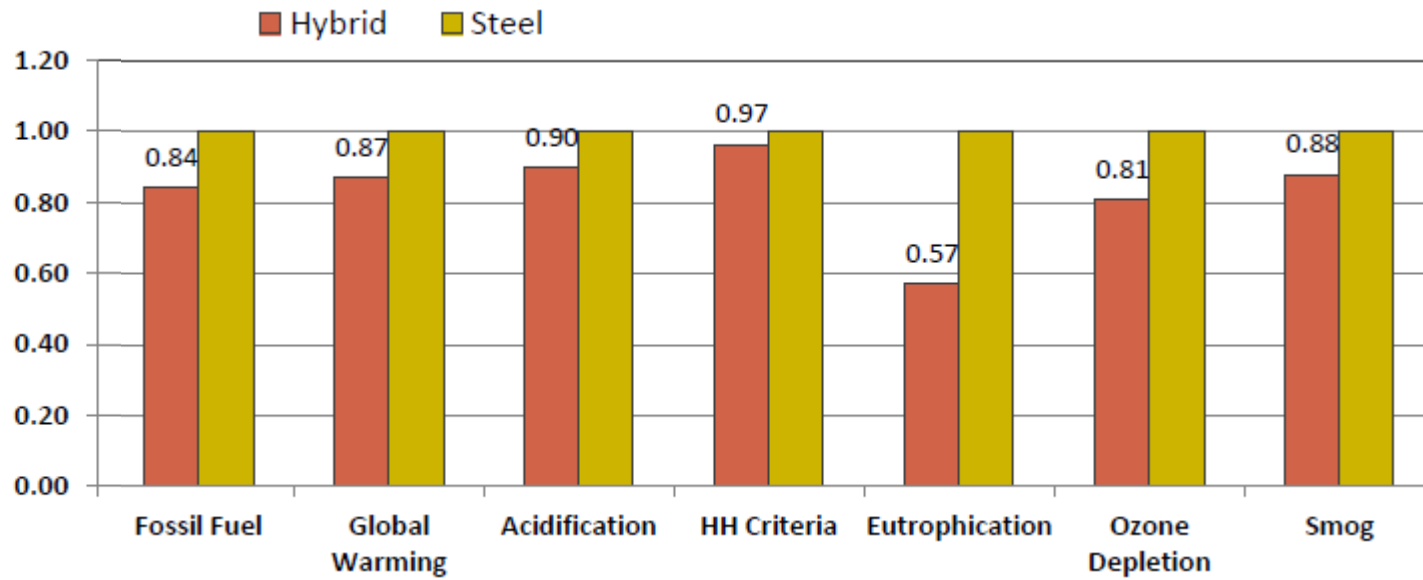
# Applying LCA on Projects

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## 1. Building design

- Compare impacts of proposed and reference designs.

### Normalized Environmental Impact Comparison of Proposed and Reference Building Designs

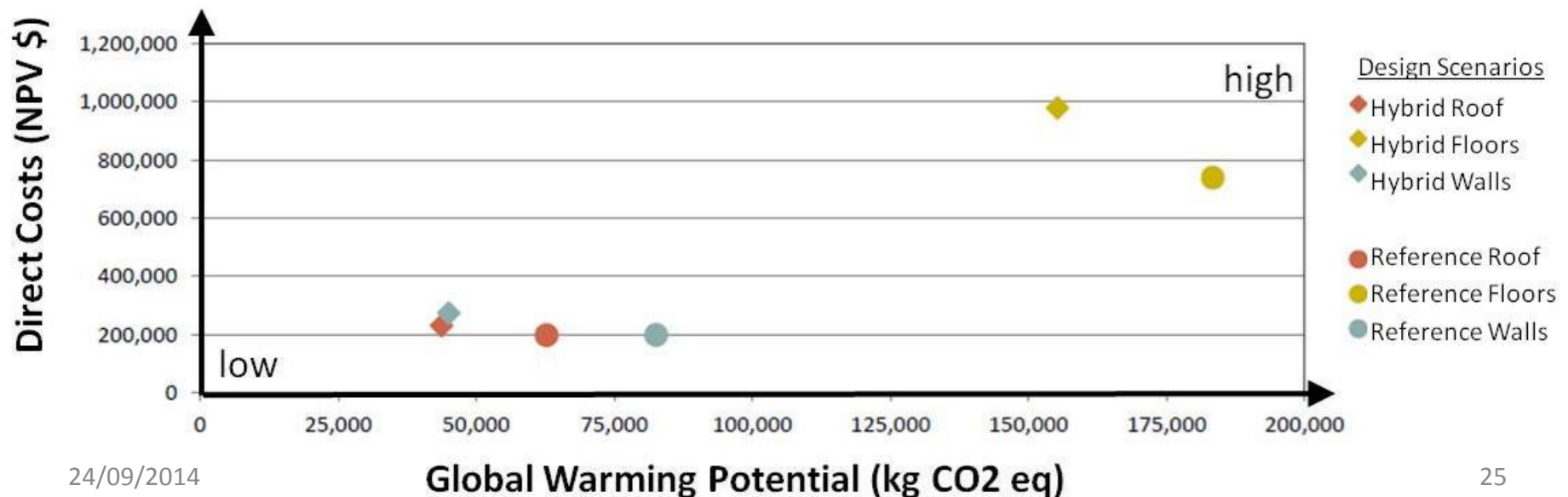




## 2. Integrated Analysis

- Develop LCA study in-step with financial costing information

Comparison of Building Element Design Scenarios by their Outcomes on Direct Costs and Global Warming Potential.



## 3. Building Declaration

- Report summarizing LCA study
- Submit for recognition from
  - LEED v.4 – Material and Resources
    - » 3 credits for *Building Life-Cycle Impact Reduction*.
  - Green Globes - Materials and Resources
    - » 33 points for whole-building comparative LCA performance path option of building core and shell.
- Marketing and Communication
  - Clearly show outcomes of design strategies

# Applying LCA on Projects

**Table 2: Compliance Requirements in the Programs**

	LEED v4	Green Globes 2013 <sup>8</sup>	IgCC 2012	CALGreen 2010/2012
Impact Indicators to be Quantified	Global warming potential Acidification potential Eutrophication potential Ozone depletion potential Smog potential			
	Non-renewable primary energy	Fossil fuel primary energy	Total primary energy	Fossil fuel primary energy
Improvement Target (Proposed Building relative to Reference Building)	Minimum 10% reduction for at least three of the impact indicators, one of which must be global warming potential. <sup>9</sup>	Minimum 10% reduction for at least three impact indicators, one of which must be global warming potential; or, minimum 15% reduction for at two indicators, one of which must be GWP; or, minimum 20% reduction in GWP.	Minimum 20% reduction for at least three impact indicators, one of which must be global warming potential.	Minimum 10% reduction for at least three impact indicators, one of which must be global warming potential.
Exceedance Limit (Proposed Building relative to Reference Building)	Maximum 5% increase for any impact indicator	No more than one impact indicator can increase.	None stated	None stated
Study Period	Minimum 60 years	Minimum of 60 years and maximum of 120 years, unless otherwise approved by a Green Globes assessor	None stated	Minimum 60 years unless approved by the enforcing agency

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# Outline

## 1. LCA opportunities in Construction Industry.

- Move towards performance based design and disclosure.

## 2. Tools

- Use for building design and detailed modeling

## 3. Applying LCA on projects.

- Building design, integrated analysis and declaration.